ENEFIT'S OIL SHALE PROJECTS

Indrek Aarna
Head of R&D, Enefit

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Enefit

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Enefit in Brief

Eesti Energia is the largest oil shale to energy company in the world.
Our activities outside Estonia are called Enefit.

Oil Shale Mining	Oil Shale Power Generation	Shale Oil Production	International Development
• Almost 100 years operations, more than 1 bn tons of oil shale mined to date • Reserves of more than 1 bn tons • Annual production ca. 15-17 M tons • 3 operating mines: 1 surface, 2 underground • 3,000 mining employees • Experienced in remediation 12,000 hectares restored	• Provides 91% of Estonia's electricity, more than 600 TWh produced to date • 2,380 MW of oil shale fired capacity world largest oil shale power plants • Allows significant electricity exports to Baltic region and Finland • Ensures security of supply • Approx 881 employees	• 50 years of surface retorting experience • More than 200 M bbl oil produced to date • 30 years of commercial operation of the Enefit140 units • 2012 annual production more than 1.3 M bbl • New generation Enefit280 is in hot commissioning in Estonia	• Based on Enefit280 shale oil production technology • USA: 50,000 bbl/d oil, resource is owned/leased • Jordan: 38,000 bbl/d shale oil production, 474 MW power production, resource is via concession • Enefit280 technology is available for licensing

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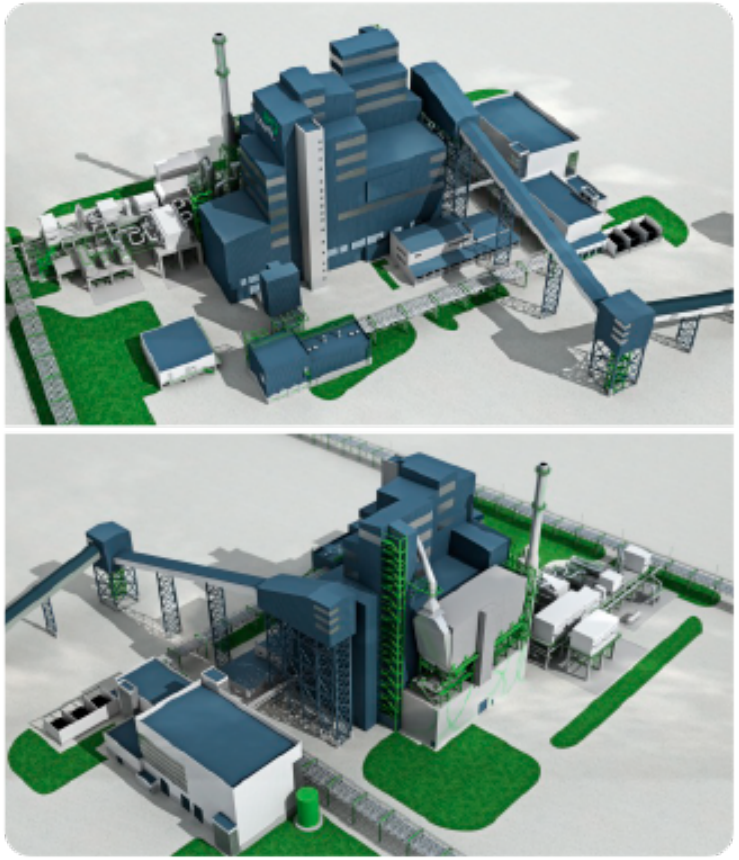
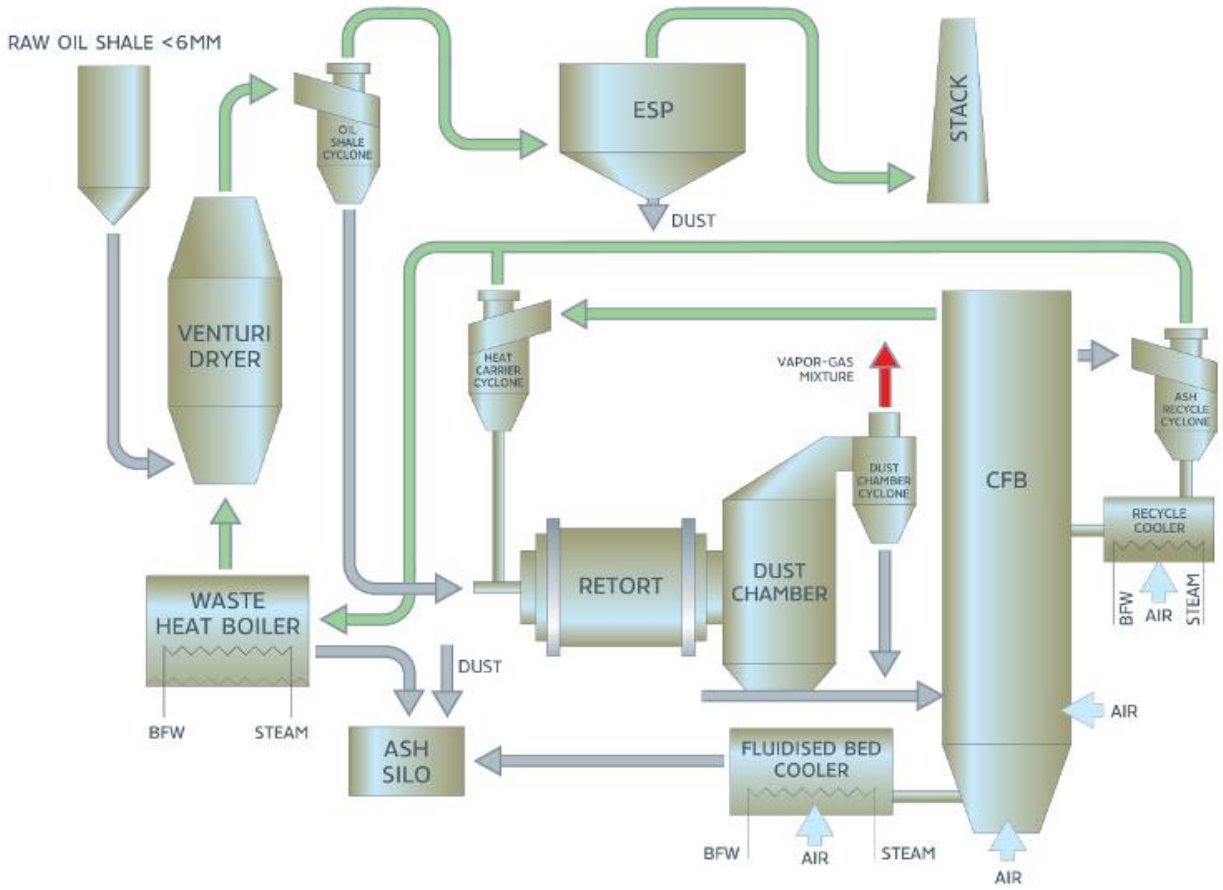
Enefit’s shale oil production today

Enefit280 technology

- Technology developed in cooperation with Outotec GmbH
- Annual oil shale consumption: **2.5 mil. tons**
- Annual shale oil production: **315,000 tons**
- Annual retort gas production: **2,650 mil ft^3**
- Annual power production: **280 GWh**
- Technical characteristics:
  - Double unit capacity – 308 tons/h
  - High availability
  - Meets strict EU environmental standards
  - High thermal efficiency
- The first plant is ready and currently in hot commissioning
- The first barrel of oil was produced in December 2012



Enefit280 process



Unit size

- Double size of it's predecessor Enefit140

Availability

- The availability of the unit should reach over 90%

Efficiency

- The Enefit280 unit will recover heat from the ash and flue gases
- The heat is used for power production

Lower environmental impact

- The lift pipe combustor has been replaced by CFB boiler which will result in a more complete combustion of the spent shale and cleaner flue gases

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Enefit280 plant in Estonia

Enefit280 will be put into commercial operation in 2013.
This would prove the new retorting concept, which is the basis for our Estonian expansion and international projects.

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Production of motor fuels from shale oil

- In 1980's syncrude was produced from shale oil in US
- Parachute Creek (CO) plant proved that it is technically possible to produce motor fuels from shale oil
- Motor fuels that meet today's specifications have been never produced from Estonian oil shale

Comparison of different shale oil properties:

		Utah shale oil	Attarat shale oil	Estonian shale oil
API gravity	°API	25	18.2	21.3
Pour Point	°F	**64**	-6	-76
Chemical composition of shale oil				
Carbon content	wt.-%	83.41	79.85	83.4
Hydrogen content	wt.-%	11.23	9.7	10.4
Nitrogen	wt.-%	**1.74**	0.5	0.19
Sulfur	wt.-%	0.5	**9.04**	0.75
Oxygen	wt.-%	1.19	1	**5.23**

Every shale oil is different and upgrading concept should take these differences into account.

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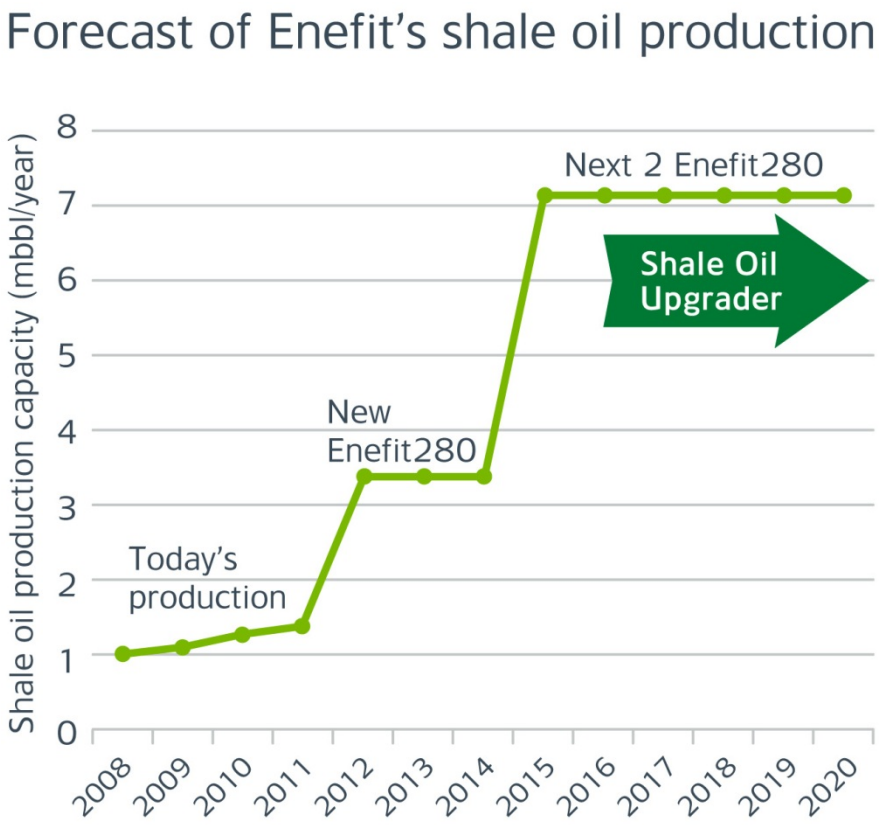
Shale oil upgrader in Estonia

- Enefit plans to expand its shale oil production capacity to 22,000 BPSD by 2016
- Enefit has successfully tested hydroprocessing of Estonian shale oil in 3 different laboratories
- Enefit completed the upgrader pre-FEED study in 2012
- Enefit started the upgrader FEED study in December 2012
- Enefit plans to make an investment decision to expand its shale oil production and build an upgrader in 2014



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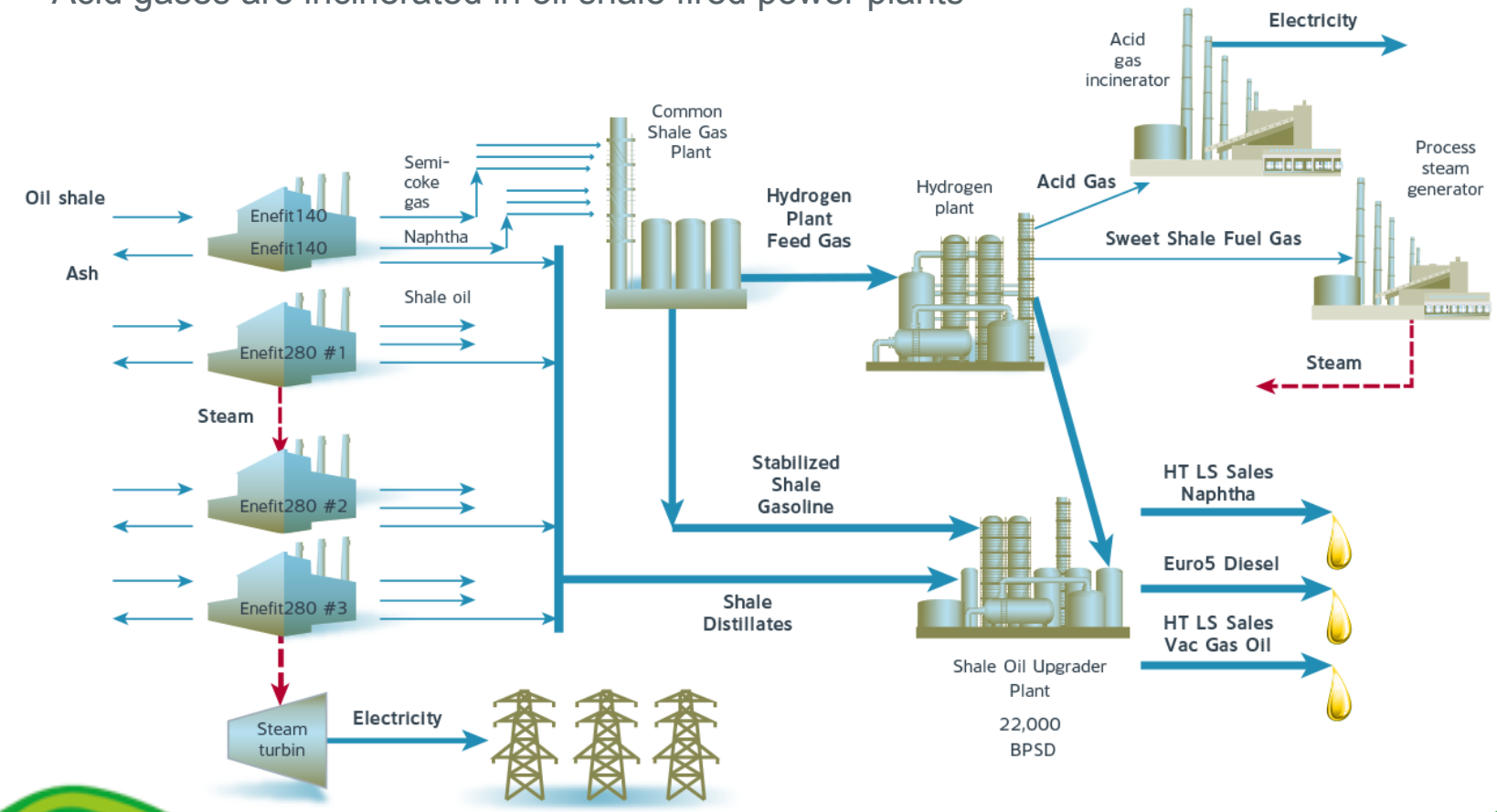
Oil Shale Industry Scheme

Upgrader concept:

- POX technology is used for hydrogen production from retort gas
- Hydrotreatment includes guard, hydrotreatment and hydrocracking rectors
- Acid gases are incinerated in oil shale fired power plants



Enefit Shale Oil industry in Estonia in 2016

Enefit shale oil upgrader should be ready in 2016. This would prove the overall technical and commercial viability of production of motor fuels out of oil shale.

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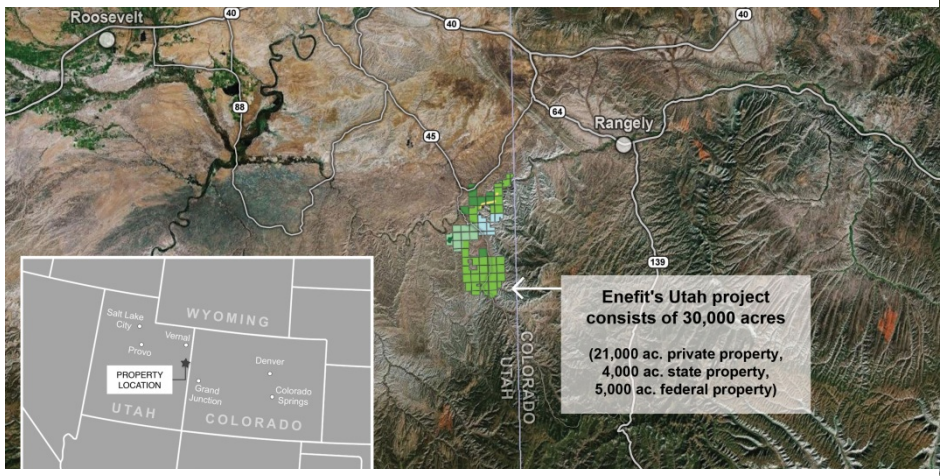
Enefit development project in Utah (USA)

Enefit Amercian Oil (EAO) ownership: 100% Enefit

Project schedule:

- 25,000 BPSD of shale oil in 2020
- 50,000 BPSD total capacity of Enefit shale oil plants in 2024

Resource in USA, Utah



- Oil in Utah, approximately 200 miles east of Salt Lake City
- Total resource of EAO is 2.6 billion bbl of oil
- EAO Resource: private property, leases and options

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Enefit development projects in Jordan

Jordan Oil Shale Energy (JOSE) ownership:
65% Enefit, 30% YTL, 5% Near East Group

Project schedule:

- 474 MW oil shale fired power station in 2016
- 19,000 BPSD of shale oil in 2020
- 38,000 BPSD total capacity of Enefit shale oil plants in 2024

Concession Area in Jordan

- Oil Approximately 50 miles south of Amman
- Total resource of JOSE is 1.9 billion bbl of oil
- JOSE Resource: Concession Agreement

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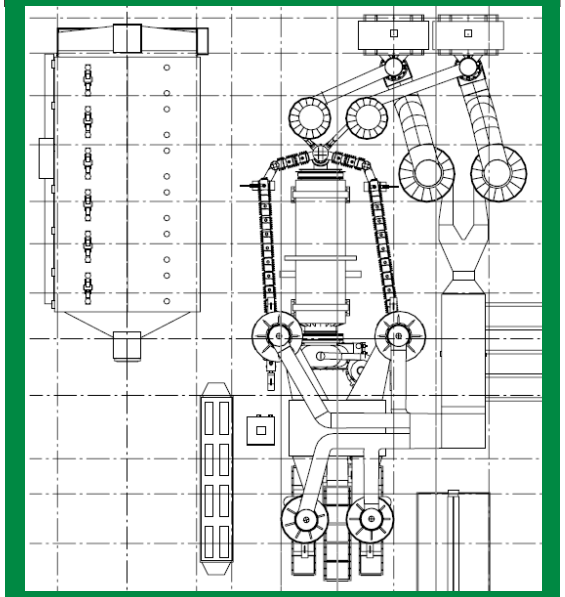
Enefit technology development for Utah and Jordan

- Laboratory-scale tests have been carried out with oil shale from Utah and Jordan:
  - Oil shale crushing
  - Oil shale characterization
  - Oil shale and spent shale combustion
  - Retorting
- Representative shale oil, retort gas, sour process water and spent shale samples have been collected from the Enefit bench-scale units tests and further detailed analyses performed.
- Preliminary Enefit process concepts (accuracy ±30%) have been developed:
  - Utah: 306 tons/hr
  - Jordan: 594 tons/hr
- Enefit pilot plant tests will be performed in 2013
  - Pilot plant is under construction in Frankfurt (Germany)
  - Pilot plant will be ready in February 2013

Enefit bench-scale unit

Initial Plant Arrangement



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Conclusions

- Enefit280 retort has produced the first oil in Estonia, which proves the new retorting concept
- Enefit has fixed the shale oil upgrading concept and started the FEED study for the upgrader in Estonia
- Success of shale oil production expansion and shale oil upgrading project is crucial for development of our international projects in Utah and Jordan
- Enefit has made bench-scale tests with Utah and Jordanian oil shales. Pilot plant programs will be performed in 2013

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Thank you!

Dr. Indrek Aarna

Head of R&D, Enefit
Laki 24, 12915 Tallinn, Estonia
Phone: +372 715 2301

Indrek.Aarna@enefit.ee
www.enefit.ee

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